



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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In re application of:

ROBERT W. MASON

Group Art Unit: 1625

Serial No.: 09/664,105

Examiner: Taylor V. Oh

Filed: September 19, 2000

For: NON-PHOSGENE ROUTE TO THE MANUFACTURE
OF ORGANIC ISOCYANATES

Attorney Docket No.: LYON 0117 PUS

APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
U.S. Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Appellants hereby appeal the rejection of claims 26, 28, 31, 33, 37, 42, 46, 48, 50, and 52. Claims 26-53 are pending, and since no rejection is of record for claims 29, 30, 32, 34-36, 38-41, 43-45, 47, 49, 51, and 53, these claims must be allowable, although neither the Final Office Action of May 21, 2003 nor the Advisory Action of July 22, 2003 indicated that this is the case. There is no outstanding rejection of these claims. This Brief is submitted in triplicate.

I. REAL PARTY IN INTEREST

The real party in interest is ARCO Chemical Technology, L.P., a corporation

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organized and existing under the laws of the state of Delaware, and having a place of business at Two Greenville Crossing, 4001 Kennett Pike, Suite 238, Greenville, Delaware 19807, as set forth in the assignment recorded in the U.S. Patent and Trademark Office on December 27, 2000 at Reel 011409, Frame 0420.

II. RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences known to appellant, the appellant's legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 26-52 are pending in this application. Claims 26-28, 31, 33, 37, 42, 46, 48, 50, and 52 have been rejected under 35 U.S.C. § 112. There is no prior art rejection. The remaining claims are believed allowable, and this believed status is indicated in the complete list of claims in Appendix A by the word "allowable" following the claim. The rejection of claims 26, 28, 31, 33, 37, 42, 46, 48, 50, and 52 is appealed.

IV. STATUS OF AMENDMENTS

No claim amendments have been made subsequent to the Final Rejection dated May 21, 2003. Appellant's response dated June 30, 2003 has been entered (no claim amendments made). In the Advisory Action dated July 22, 2003, all prior art rejections were withdrawn. Claim 27, a duplicate of claim 26, is cancelled herewith.

V. SUMMARY OF THE INVENTION

The subject invention pertains to a process for the preparation of organic isocyanates by forming a reaction mixture of an organic formamide compound of the formula $R-(NHCHO)_n$ where n is an integer from 1 to 10 and R is an organic radical (specification, page 5, lines 3-6, page 3, lines 11-26, claim 1 as filed, claim 2 as filed), with at least one

diorganocarbonate selected from the group of diarylcarbonates, mixed aliphatic/aryl-carbonates, and cycloaliphatic/aryl carbonates (claim 1 as filed; claim 10 as filed; specification page 7, line 9 to page 8, line 2); heating to an elevated temperature sufficient to generate the isocyanate corresponding to the organic formamide (claim 1 as filed; specification page 10, line 25 to page 11, line 17); and isolating the isocyanate from the reaction mixture (claim 1 as filed, specification, pages 3 to 16, particularly page 8, page 10, last paragraph to page 11, first paragraph, and the Examples). The subject invention is also directed to preparing and isolating an O-carbamate isocyanate precursor (specification, pages 10-11, claim 25 as filed).

VI. ISSUES

Issue A

Is a rejection under 35 U.S.C. § 112, ¶ 1 for alleged lack of enablement maintainable in view of a complete absence of evidence in the record to meet the burden imposed on the Patent Office by the presumptively accurate specification.

Issue B

Is a rejection for indefiniteness under 35 U.S.C. § 112, ¶ 2 maintainable when the claims are definite to one skilled in the art and no scientific basis for concluding otherwise is set forth by the Office.

VII. GROUPING OF CLAIMS

With respect to Issue A, claims 26 and 46 stand or fall together. Claim 37, further requiring a catalyst, is necessarily considered separately with respect to this additional limitation. Claims 48 and 50 do not stand or fall with claims 26, 37, and 46, because these claims specifically recite diphenylcarbonate as the diaryl carbonate used in the process. Claim 52 does not stand or

fall with any of claims 26, 37, 46, 48, or 50, as this claim is directed to a process at which an O-organocarbamate is obtained rather than an isocyanate.

With respect to Issue B, the claims do not stand or fall together. Each claim must be considered separately, as the rejection is for indefiniteness separately for each claim with regard to the individual limitations of each claim. As these limitations are different, each claim must be considered separately.

VIII. ARGUMENT

Issue A

It is well established that the requirements of 35 U.S.C. § 112, whether ¶1 or ¶2, are analyzed with respect to the knowledge of one of ordinary skill in the art. The rejection of claims 26, 37, 46, 48, 50, and 52 was originally set forth in the Office Action dated November 5, 2002 (Paper No. 6), and despite subsequent claim amendments, has not been modified or abridged.

Enablement is a question of fact, and it is well established that only objective enablement is required, i.e. the teachings of the specification being commensurate with the scope of the claims. *In re Marzocchi*, 169 USPQ 367 (CCPA 1971):

We will reverse the board's decision of this rejection since we are unable to find sufficient justification for the holding that appellants' disclosure is not enabling.

[1] Turning specifically to the objections noted by the board as indicated above, it appears that these comments indicate nothing more than a concern over the *breadth* of the disputed term. If we are correct, then the relevance of this concern escapes us. It has never been contended that appellants, when they included the disputed term in their specification, intended only to indicate a single compound. Accepting, therefore, that the term is a generic one, its recitation must be taken as an assertion by appellants that all of the "considerable number of compounds" which are included

within the generic term would, as a class, be operative to produce the asserted enhancement of adhesion characteristics. The only relevant concern of the Patent Office under these circumstances should be over the *truth* of any such assertion. The first paragraph of § 112 requires nothing more than objective enablement. How such a teaching is set forth, either by the use of illustrative examples or by broad terminology, is of no importance. (Emphasis in original.)

Marzocchi at 369. Moreover, the specification is presumptively accurate. *Marzocchi* at 370.

The nature of a legal presumption is that it apportions the burden of persuasion. A presumptively accurate specification shifts the burden to the Patent Office to rebut the presumption by supplying sound scientific argument and citations to the scientific or patent literature to support any assertion of non-enablement:

[2] As a matter of Patent Office practice, then, a specification disclosure which contains a teaching of the manner and process of making and using the invention in terms which correspond to scope to those used in describing and defining the subject matter sought to be patented *must* be taken as in compliance with the enabling requirement of the first paragraph of § 112 *unless* there is reason to doubt the objective truth of the statements contained therein which must be relied on for enabling support. Assuming that sufficient reason for such doubt does exist, a rejection for failure to teach how to make and/or use will be proper on that basis; such a rejection can be overcome by suitable proofs indicating that the teaching contained in the specification is truly enabling. (Emphasis in original.)

Marzocchi at 369.

Thus, to sustain a rejection for non-enablement under 35 U.S.C. § 112, ¶ 1, the Office must set forth objective reasoning based on sound scientific principles or cited references which lend support to the Office's position. A mere conclusory statement or broad allegation

asserting that the claims are too broad or non-enabled is insufficient. *In re Chilowsky*, 108 USPQ 575 (CCPA 1962). The legal presumption of enablement requires more.

Here, the presumption has not been overcome. The specification sets forth reactants, reaction conditions, etc., which clearly enable one skilled in the art to practice the full breadth of the invention without undue experimentation. This is further buttressed by the Declaration of the inventor, which indicates (Declaration, page 8, ¶ 12) that the invention is clearly enabled to one skilled in the art, setting forth reasons why this is so. It must be remembered that the standard for enablement allows considerable experimentation. It is only "undue experimentation" which creates enablement issues. *In re Morehouse*, 192 USPQ 29 (CCPA 1976); *In re Wertheim*, 191 USPQ 90 (CCPA 1976).

The Office cites the so-called "Wands Factors," *In re Wands*, 8 USPQ2d 1400 (Fed. Cir. 1988). Appellant fails to see the relevancy of *Wands*, and, *arguendo* if relevant, the various "factors" are clearly met.

Wands was a case dealing with an immunoassay involving particular cell lines expressing a particular antibody, in other words, a complex biotechnology case. Some 143 cell lines were prepared for use in the method, nine of which were actually screened (tested). Four of the nine produced antibodies falling within the limitations of the claims; the remaining five did not. The claims were rejected for non-enablement. The Court clearly set forth that the *Wands* case was different from other cases in general. Note page 1402, last paragraph continuing to page 1404, where the difficulties associated with disclosure for biotechnology inventions is discussed. The Court then went on to cite the factors previously considered by the Board of Appeals in *Ex parte Forman*, 230 USPQ 547 (Fed. Cir. 1986), itself also a biotechnology case. These factors are

(1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims.

Wands at 1404.

However, the Court was also careful to delineate what is meant by “undue experimentation,” citing *Ansul Co. v. Uniroyal, Inc.*, 169 USPQ 759, 762-763 (2d Cir. 1971), *cert. denied* 404 US 1018 (1972):

The test is not merely quantitative, since a considerable amount of experimentation is permissible, if it is merely routine, or if the specification in question provides a reasonable amount of guidance with respect to the direction in which the experimentation should proceed.

It should be noted that despite the complexity of the invention claimed by *Wands*, and despite failure of 5 of the 9 screened cell lines, the Court reversed the rejection of the claims for lack of enablement.

Here, complex issues of biotechnology are not involved; rather, synthetic organic chemistry is the general subject area, where chemists are highly skilled. (“Wand’s Factors” 4-6). Second, the claims are not unduly broad, and in fact have been reduced from their original scope (Factor 8). Actual examples are set forth (Factor 3), as is considerable guidance (Factor 2). As can be seen from the disclosure and examples, the results with various substrates, etc., is not unpredictable (Factor 7), and does not require undue experimentation, as set forth both in the specification and supported by the Declaration of inventor Mason (Wand’s Factor 1). Furthermore, the Court never stated that all these factors must be considered, and in fact did not do so. These factors are exemplary.

Here, for example, the Office states¹:

... because the specification, while being enabling for organic isocyanates, such as 2,4- and 2,6-toluene (TDI), 4,4'-diphenylmethane diisocyanate, 1,6-hexane diisocyanate, isophorone diisocyanate, and etc., does not reasonably provide enablement for all the organic isocyanates in the field of organic chemistry. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to all the organic isocyanates unrelated to the current invention commensurate in scope with these claims. Therefore, an appropriate correction is required. Furthermore, there are "foreman factors or Wands factors" regarding the presence or absence of working examples because the preparation of organic isocyanates (see pages 12-15) has eight examples shown in the specification.² The reaction conditions for producing organic isocyanates, such as reaction temperature and pressure, are not applicable to all the reaction conditions for all the organic isocyanates represented by the formulas in the claim 27. Thus, the specification has failed to provide sufficient working examples to support the broad spectrum of thousands represented in the formulas. In addition, more than routine experimentation is required and involved (second foremen factor).

See In re Armbruster 185 USPQ 204 9CCPA 1985) and Angstadt et al, 190 USPQ 152, (CCPA 1990).

Because the specification, while being enabling for an organic formamide compound, such as aliphatic and aryl formamides containing 1 to 10 formamide groups, does not reasonably provide enablement for all the organic formamide in the field of chemistry. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to all the organic formamide unrelated to the current

¹ Office Action dated November 5, 2002, the last Office Action which recited the substance of the rejections under 35 U.S.C. § 112.

² Thus, unlike some applications, which are enabling despite having no examples, the subject application has eight examples. The specification clearly meets the "presence/absence" test.

invention commensurate in scope with this claims. Therefore, an appropriate correction is required. (Second incidence of emphasis added.)

It thus appears from this passage, that it is the breadth of the claims that is at issue rather than enablement. As indicated by *Marzocchi*, objective enablement is all that is required, and the claims here are no more broad than the specification. For example, organo R groups are broadly discussed on page 5 of the specification, and more specifically at numerous other portions.

With respect to the reaction conditions, these are clearly enabled by the specification, and for any particular isocyanate, formamide, O-carbamate, etc., requires no more than routine experimentation, as set forth on page 10, line 25 to page 11, line 17. For carbamate decomposition temperatures, for example, which the specification indicates to be substrate-dependent (page 10, line 30 to page 11, line 2), DSC or other routine methods may be employed. No undue experimentation is involved. Most importantly, the Office has completely failed to set forth any objectively based reasoning for its non-enablement position. Whether the claims pertain to a single compound, thousands of compounds, or trillions of compounds is irrelevant unless reasoning is advanced by the Office to support its position. *Marzocchi, op. cit.*; *Chilowsky, op. cit.*

The Office continues:

Because the specification, while being enabling for a diorganocarbonate, such as dimethylcarbonate, diethylcarbonate, di(n-propyl) carbonate, di(n-hexyl)carbonate, di(2-ethylhexyl)carbonate, diphenylcarbonate, di(4-chlorophenyl) [sic] carbonate, does not reasonably provide enablement for all the diorganocarbonates in the field of chemistry. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to all the diorganocarbonates unrelated to the current invention commensurate in scope with these claims. Therefore, an appropriate correction is required.

However, all these diorganocarbonates are outside the scope of the claims, with the exception of diphenylcarbonate and di(4-chlorophenyl) carbonate. The latter two are distinctly identified in the specification, and many examples of the use of diphenylcarbonate are given. The Office has provided no objective evidence to place any doubt as to the use or conditions of use of any of the claimed diaryl-, aryl/aliphatic-, or aryl/cycloaliphatic- carbonates. Claims 48 and 50 specifically recite diphenyl carbonate. The claims are no broader than the specification in this regard, and are clearly enabled. *Marzocchi, op. cit.*

The Office continues:

Because the specification, while being enabling for an amine,³ such as aniline, 2-, 3-, and 4-methylamine, 1,2-, 1,3-, and 1,4-phenylene diamine, 2,4-, 2,6-, and 3,5- toluene diamine, 2,2'-, 2,4', 4,4'-diaminodiphenylmethane [sic], diaminodiphenylsulfones [sic], diaminodiphenyloxides, diaminodiphenylsulfides [sic], does not reasonably provide enablement for all the amines in the field of organic chemistry. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to all the amines unrelated to the current invention commensurate in scope with these claims. Therefore, an appropriate correction is required.

The amines which are useful are the same as the formamides derived therefrom, which are described on pages 5-7 of the specification. There is no evidence which supports any conclusion of non-enablement. Any organoamine capable of forming a formamide should be useful, and there is no reason to suspect otherwise. The reactive group which participates in the reaction with the aryl or mixed-aryl carbonate is the formamide group, not the organo group. Even if certain amines/formamides would not work, this is not an issue (*see Wands*, for example, when 5 of 9 cell lines did not work), as the claims require isolating an isocyanate (or, claim 52, an O-carbamate).

³ Amines can serve as the precursors to the formamide reactants of the subject claims, and may serve to prepare the latter *in situ* as well.

Thus, a reaction which does not work will not produce an isocyanate, and when an isocyanate cannot be isolated, the reaction is not within the scope of the claims. Enablement is assessed relative to the claim scope, not with regard as to what is not claimed. Again, no objective evidence to support non-enablement is given.

Finally, with respect to 35 U.S.C. § 112, ¶ 1, the Office states:

Because the specification, while being enabling for a metal catalyst, such as transition metal, regular group metal salts, complexes, organometallic compounds, copper, tin, and zinc salts, does not reasonably provide enablement for all the metal catalysts in the field of organic chemistry. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to all the metal catalysts unrelated to the current invention commensurate in scope with these claims. Therefore, an appropriate correction is required. Furthermore, a metal catalyst may represent an unpredictable aspect in the art of organic chemistry. See *Exparte Sizto*, 9 USP12d (Bd. of App. And Inter. March 1988).

Examples of metal catalysts (whose use is not preferred) are set forth on page 11, line 27 to page 12, line 4. One skilled in the art can easily determine whether any given catalyst will work by simply comparing the reaction rate and yield to a similar uncatalyzed process. The specification provides clear guidance to catalyst selection, and for specific catalysts, only routine experimentation is involved. Moreover, the claims require (claim 37) an effective amount of metal catalyst. If a particular metal compound does not act catalytically it cannot be "effective", and is not within the scope of the claims. Claim 37 is clearly enabled with respect to the catalyst limitation.

In summary, with respect to the rejections of claims 26, 37, 46, 48, 50, and 52, each of these claims is no broader than the presumptively enabling disclosure, and are therefore enabled under the requirements of *In re Marzocchi*. The claimed invention is not unpredictable, and selection of substrates, reaction conditions, etc. are set forth in the specification, the subject

of numerous examples, and for those substrates, catalysts, etc., which are not specifically enumerated, all parameters are easily determined by one skilled in the art without undue experimentation. Moreover, and in contravention to *Marzocchi*, the Office has set forth no objective evidence to place any doubt on the presumptively accurate specification. The rejections of claims 48 and 50, which specify diphenyl carbonate as the diorganocarbonate are yet more clearly enabled with respect to this aspect, as is also claim 37. Reversal of the rejection for lack of enablement under 35 U.S.C. § 112, ¶1 is solicited.

Issue B

As with enablement, definiteness under 35 U.S.C. § 112, ¶2 is assessed by one of ordinary skill in the art. Moreover, a claim which is understandable and which defines the subject matter which Appellant regards as his invention meets the requirements of 35 U.S.C. § 112, ¶2. *In re Kamal*, 158 USPQ 320 (CCPA 1968); *In re Borkowski*, 164 USPQ 642 (CCPA 1970); and breadth alone is not indefiniteness, *In re Gardner*, 166 USPQ 138 (CCPA 1970). Finally, if one can determine whether any set of reactions or reaction conditions are not within the scope of a process claim, the claims is not indefinite. *In re Mercier*, 185 USPQ 774 (CCPA 1975). Claims 26, 27, 28, 31, 33, 37, and 42 have been rejected under this section of the statute. These claims are all definite to one skilled in the art. Again, references to "Office Action" are to the Office Action of November 5, 2002.

The Office Action states:

In claim 26, a phrase "an elevated temperature" is written. However, this does not describe what the effective range of the elevated temperature is. An appropriate correction is required.

Claim 26 does not merely express "an elevated temperature" the correct phrase is "an elevated temperature sufficient to generate the isocyanate corresponding to said organic formamide compound." On page 10, line 30 to page 11, line 2, this thermolysis temperature is

stated to be substrate dependent, and easily ascertained. For example, trial runs may be made at different temperatures, using the temperatures set forth on page 11, lines 2-17 as a guide, or a more precise thermolysis temperature may be measured by DSC (Differential Scanning Calorimetry), in either case requiring no more than routine experimentation. *See* also the Mason Declaration, page 8, ¶ 12. A specification and its associated claims are not a production specification for each and every embodiment falling within the scope of the claims. To one skilled in the art, the temperature limitation is clear. Claim 26 fully meets the definiteness requirements of 35 U.S.C. § 112, ¶ 2. Reversal is solicited.

The Office continues:

In claim 27, a phrase "an organic radical" is written. However, "an organic radical" is vague and indefinite. This does not explain what kind of the organic radical group is belonged to R in the formula. An appropriate correction is required.

Claim 27 is redundant to claim 26, which contains the same language, and has been cancelled herewith. No rejection based on this language has been made with regard to claim 26, but had one been made, the claim language fully meets the requirements of 35 U.S.C. § 112, ¶ 2. Organic radicals R are clearly described in the specification, including page 4, line 6 to page 7, line 5. The term "organic radical" is also well known to the organic chemist. The definiteness requirement is present in the law to give notice to the public as to what might constitute infringement. If the process of claim 26 is practiced with any formamide containing an R organic radical, it infringes. Thus, the claim is definite. Reversal is solicited as to any rejection which might apply to claim 26.

The Office continues:

In claim 28, "R may contain one or more ring heteroatoms" is written. However, this is vague and indefinite. This does not explain what one or more chain and ring heteroatoms are represented for the R group. An appropriate correction is required.

Examples of heteroatoms are given on page 6, lines 2-16. A "chain or ring heteroatom" is used in the traditional sense as an at least bivalent, non-carbon atom. Examples include O, S, and in some cases, N, as discussed. One skilled in organic chemistry is aware of the definition of "chain or ring heteroatom" as it applies to organic compounds. There is no indefiniteness here. Reversal is solicited for claim 28.

The Office continues:

In claim 31, a phrase "at a temperature wherein isocyanate is produced" is written. However, this does not describe at what temperature the isocyanate is produced. An appropriate correction is required.

As indicated on page 10, line 30 to page 11, line 2, the exact temperature is substrate-dependent. A single temperature cannot be set forth. However, as indicated previously, suitable temperatures can be determined by routine experimentation. The goal of the invention is to isolate isocyanates from the reaction of a formamide with specific diaryl- or mixed aryl carbonates. If one practices this reaction and isolates an isocyanate, it is clear that the temperature limitation of the claim is met. Claiming a temperature by the effect it creates is not indefinite. Describing a process employing a step of "lowering the temperature to the solvent freezing point," for example, is clearly definite, even though different solvents have different freezing points. Claim 31 is definite. Reversal is solicited.

The Office continues:

In claim 33, a phrase "thermolyzing said isocyanate precursor mixture at a second higher temperature to obtain the isocyanate" is written. However, this does not describe at what second temperature the isocyanate is produced. An appropriate correction is required.

The second, higher temperature is above the first temperature, which is below 190°C. Isocyanate production at any given temperature can be assessed by routine analytical methods. Thus, the first and second temperatures are both easily determined. If one practices the invention at a temperature below 190°C and obtains substantially no isocyanate and then heats the mixture to a second, higher temperature to obtain the isocyanate, it is clear that such a process would infringe claim 33. To one skilled in the art, claim 33 is definite. Reversal is solicited.

The Office continues:

In claim 37, a phrase "an effective carbamide-cleaving amount of a metal catalyst" is written. However, the term "an effective amount" is indefinite where the claim fails to state the function which is to be rendered effective. An appropriate correction is required.

This rejection is not understood. The phrase "an effective carbamide-cleaving amount of a metal catalyst" clearly states the function: "carbamide-cleaving." If a catalyst increases the rate of carbamide-cleaving, it is an effective amount. Claim 37 is definite. Reversal is solicited.

The Office further states:

In claim 42, a phrase "their heteroatoms substituted analogs, and mixtures thereof" is written. However, this does not describe what their heteroatoms substituted analogs, and mixtures thereof are in the claim. An appropriate correction is required.

Appellant again fails to understand this rejection. If the organo group is one of those listed, but contains a heteroatom in lieu of a carbon atom, it is a heteroatom substituted analog. Examples of pairs of compounds and their heteroatom substituted analogs are phenyl and pyridyl, cyclopentyl and tetrahydrofuranyl, and hexyl and 3-oxahexyl. To one skilled in the art, claim 42 is definite. Reversal is solicited.

In summary, each of claims 26, 28, 31, 33, 37, and 42 are definite to one skilled in the art. The claims serve a notice function to the public so that infringement can be determined. One skilled in the art, viewing each of the claims which have been rejected, can immediately determine whether any proposed process infringes the claims. Thus, each claim fully meets the definiteness requirements of 35 U.S.C. § 112, ¶ 2.

* * * * *

Based on the above, reversal of all the rejections under 35 U.S.C. § 112, ¶ 1 and 2 is solicited.

The fee of \$330.00 as applicable under the provisions of 37 C.F.R. § 1.17(c) is enclosed. Please charge any additional fee or credit any overpayment in connection with this filing to our Deposit Account No. 02-3978. A duplicate of this notice is enclosed for this purpose.

Respectfully submitted,

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Enclosure - Appendix

IX. APPENDIX - CLAIMS ON APPEAL

¹
~~26.~~ A process for the preparation of organic isocyanates, said process comprising:

- a) forming a reaction mixture by mixing an organic formamide compound or its amine and formate precursors with at least one diorganocarbonate selected from the group consisting of diarylcarbonates, mixed aliphatic/aryl-carbonates and cycloaliphatic/aryl-carbonates;
- b) subjecting said reaction mixture to an elevated temperature sufficient to generate the isocyanate corresponding to said organic formamide compound; and
- c) isolating said isocyanate from said reaction mixture;

wherein said organic formamide compound is one of the formula



where n is an integer from 1 to 10 and R is an organic radical.

²
~~27.~~ (Cancelled herewith) The process of claim ¹~~26~~, wherein said organic formamide compound is one of the formula



where n is an integer from 1 to 10 and R is an organic radical.

³
~~28.~~ ²The process of claim ~~27~~, wherein R comprises an optionally substituted C₁₋₂₀ alkyl, C₂₋₂₀ alkenyl, C₂₋₂₀ alkynyl, C₄₋₂₀ cycloalkyl, C₄₋₂₀ cycloalkenyl, C₆₋₃₀ aryl, C₇₋₃₀ aralkyl, C₇₋₃₀ alkaryl group, a silane or siloxane or oligomer thereof wherein formamide group(s) are bound to

an Si-C-bonded hydrocarbon group, and wherein each of the above R may contain one or more chain or ring heteroatoms.

4 ~~29~~.² (Allowable) The process of claim ~~27~~, wherein R is selected from the group consisting of optionally substituted phenyl, diphenylmethane, and tolyl groups.

5 ~~30~~.⁴ (Allowable) The process of claim ~~29~~, wherein R is the 2,4-bis(N-formamide) of toluene diamine.

6 ~~31~~.¹ The process of claim ~~28~~, wherein steps a) and b) are combined such that the reaction temperature of step a) is maintained at a temperature wherein isocyanate is produced directly without prior isolation of O-organocarbamate from said reaction mixture.

7 ~~32~~.⁶ (Allowable) The process of claim ~~31~~, wherein the temperature of steps a) and b) are in the range of 150°C to 240°C.

8 ~~33~~.¹ The process of claim ~~26~~, wherein the temperature of step a) is maintained below 190°C and at a first temperature such that no substantial production of isocyanate occurs, said process further comprising:

- a)i) isolating an intermediate, isocyanate precursor mixture containing a carbamate group-containing reaction product, and thermolyzing said isocyanate precursor mixture at a second, higher temperature to obtain the isocyanate corresponding to said organic formamide.

9 ~~34~~.⁸ (Allowable) The process of claim ~~33~~, wherein said isocyanate precursor reaction mixture comprises in excess of 80 mol percent of the carbamate corresponding to said

organic formamide, said mol percent based on the total of mols of isocyanate, carbamates and isocyanate/carbamate contained in said isocyanate precursor reaction mixture.

¹⁰
~~35~~. (Allowable) The process of claim ~~26~~¹, wherein said diorganocarbonate is a diarylcarbonate.

¹¹
~~36~~. (Allowable) The process of claim ~~26~~¹, wherein said diorganocarbonate is diphenylcarbonate.

¹²
~~37~~. The process of claim ~~27~~², wherein R is aliphatic or cycloaliphatic, said process further comprising adding to said reaction mixture a metal catalyst which is effective to accelerate cleavage of carbamates produced by said process.

¹³
~~38~~. (Allowable) The process of claim ~~26~~¹, wherein the ratio of mols of diorganocarbonate to organic formamide is greater than 1:1 based on mols of formamide groups.

¹⁴
~~39~~. (Allowable) The process of claim ~~26~~¹, wherein the ratio of mols of diorganocarbonate to mols of formamide groups is 2:1 to 5:1.

¹⁵
~~40~~. (Allowable) The process of claim ~~26~~¹, wherein no catalyst is present.

¹⁶
~~41~~. (Allowable) The process of claim ~~26~~¹, wherein one or more organic di- or polyamines, an organoformate ester, and diorganophenol carbonate comprise said reaction mixture.

¹⁷
~~42~~. The process of claim ~~41~~¹⁶, wherein said organo group of said organoformate is the same as at least one of the organo groups of said diorganocarbonate, said organo groups

selected from the group consisting of C₁₋₂₀ aliphatic, C₄₋₂₀ cycloaliphatic, C₆₋₂₀ aryl, C₇₋₃₀ aralkyl, and C₇₋₃₀ alkaryl groups, their heteroatom substituted analogs, and mixtures thereof.

18/43. (Allowable) The process of claim 16, wherein said organo groups are selected from the group consisting of C₁₋₂₀ alkyl, C₅₋₈ cycloalkyl, and optionally substituted C₆₋₁₀ aryl.

19/44. (Allowable) The process of claim 16, wherein all organo groups are phenyl.

20/45. (Allowable) The process of claim 16, which is a continuous process wherein organoformate is removed from said reaction mixture and recycled to said reaction mixture with additional organic di- or polyamine.

21/46. A process for the direct manufacture of an organic isocyanate from the corresponding formamide, said process comprising:

- a) reacting an organic formamide containing from 1 to 10 formamide groups per molecule with from 1 to about 10 mol of diorganocarbonate per mol of formamide groups to form a reaction mixture, said reacting taking place at a temperature such that thermolysis of products contained in said reaction mixture generates the isocyanate corresponding to said organic formamide;
- b) separating said isocyanate from said reaction mixture.

22/47. (Allowable) The process of claim 21, wherein said isocyanate separated from said reaction mixture also contains partially thermolyzed products containing carbamates corresponding to said organic formamide and/or mixed isocyanate/carbamide compounds corresponding to said organic formamide, said process further comprising:

- b)i) further thermolyzing said partially thermolyzed products to form additional isocyanate corresponding to said organic formamide; or
- b)ii) returning said partially thermolyzed products to said reaction mixture; or
- b)iii) performing both of b)i) and b)ii).

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48. The process of claim 46, wherein diphenylcarbonate is employed as said diorganocarbonate, reaction takes place in phenol solvent, and said isocyanate separated from said reaction mixture contains phenol and phenol formate ester, said process further comprising recycling said phenol formate ester by reacting said phenol formate ester with an organic amine corresponding to said organic formamide to form said organic formamide.

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49. (Allowable) The process of claim 46, wherein said organoformate has a boiling point above the decomposition temperature of the O-organocarbonate corresponding to the organic formamide.

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50. A continuous process for producing organic isocyanates, said process comprising:

- a) reacting an aryl di- or polyformamide or an amine and formate precursor thereof, with diphenyl carbonate at a temperature at least sufficient to form a reaction mixture containing O-phenylcarbarnates corresponding to said aryl di- or polyformamide;
- b) thermolyzing all or a portion of said reaction mixture to generate an isocyanate-containing mixture comprising organic isocyanate(s) corresponding to said aryl di- or polyformamide;
- c) separating said organic isocyanate from said isocyanate-containing mixture to obtain a purified organic isocyanate, and an organic isocyanate depleted mixture c)i);

- d) separating phenol from said isocyanate-containing mixture or from said organic isocyanate-depleted mixture to form a phenol-depleted mixture d)i);
- e) separating carbamates and carbamate/isocyanates from said isocyanate-containing mixture or from said mixture c)i), or d)i) and further processing said carbamates and carbamate/isocyanates by one or both of
 - e)i) further thermolyzing to form said organic isocyanate(s) corresponding to said aryl di- or polyformamide; or
 - e)ii) cycling said carbamates and/or said carbamate/isocyanates into said reaction mixture of step a),
 to form a carbamate-depleted mixture e)iii
- f) separating from one or more of said isocyanate-containing mixture, c)i, d)i), or e)iii) phenol formate ester, and
- g) optionally reacting said phenol formate ester with an organic amine to form the formamide corresponding to said organic amine.

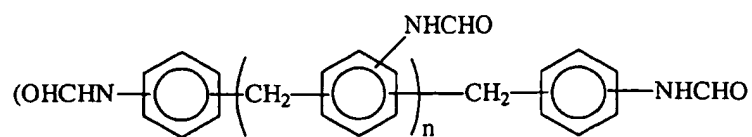
²⁶ 51. (Allowable) The process of claim ²⁵ 50, wherein said step of thermolyzing takes place at a temperature of from 150°C to 240°C.

²⁷ 52. A process for the preparation of an O-organocarbamate, said process comprising reacting an organic formamide or its amine and formate precursors with a diorganocarbonate at a temperature below that at which significant thermolysis of O-organocarbamate to isocyanate occurs, and separating said O-organocarbamate from other reaction products.

²⁸ 53. (Allowable) The process of claim ¹ 26, wherein said organic formamide compounds is one of the formula



wherein n is from 1-5 and R comprise C₆₋₃₀ aryl, or a formamide of the structure



wherein n is from 0 to 3.